THE EMPLOYMENT OF THE SINGLE CHANNEL TACTICAL SATELLITE SYSTEM AT CORPS AND DIVISION LEVEL

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE

by

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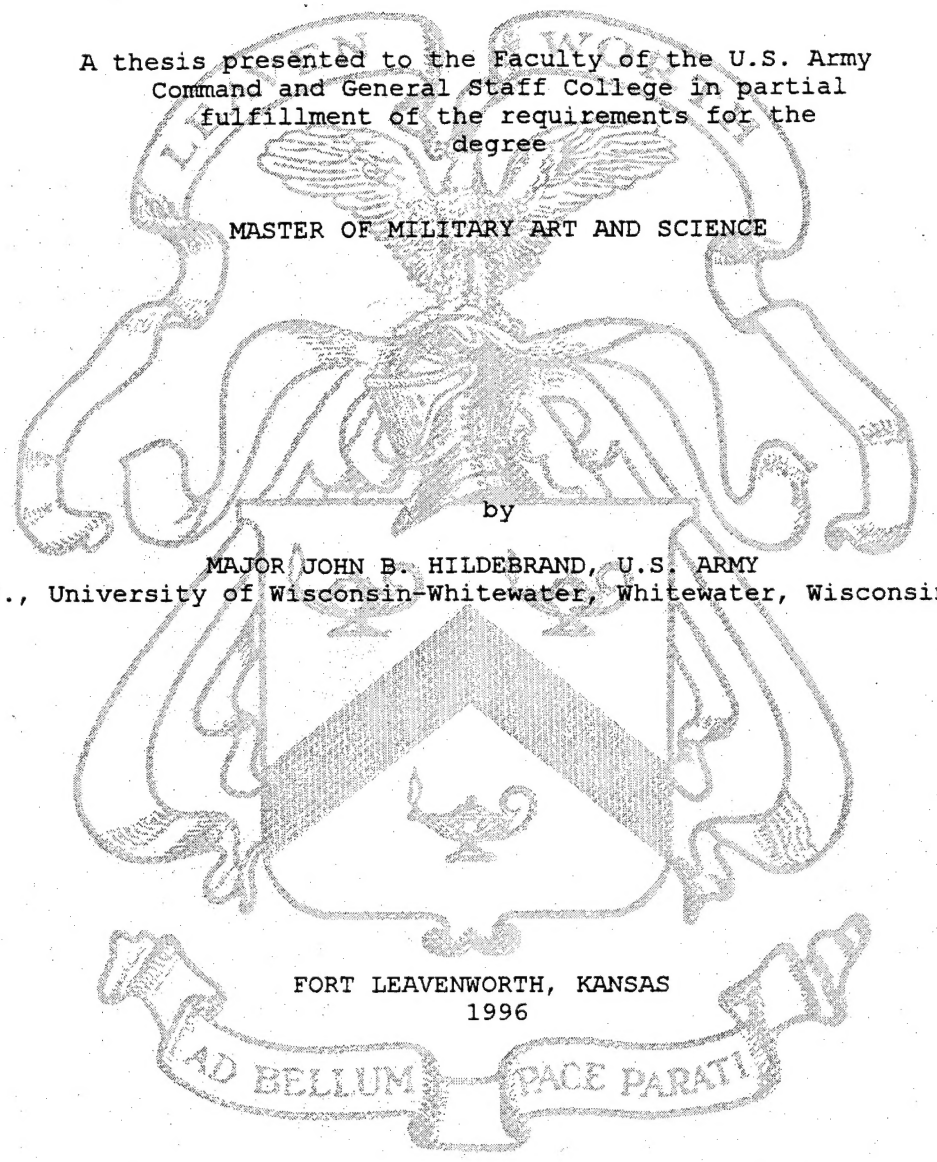

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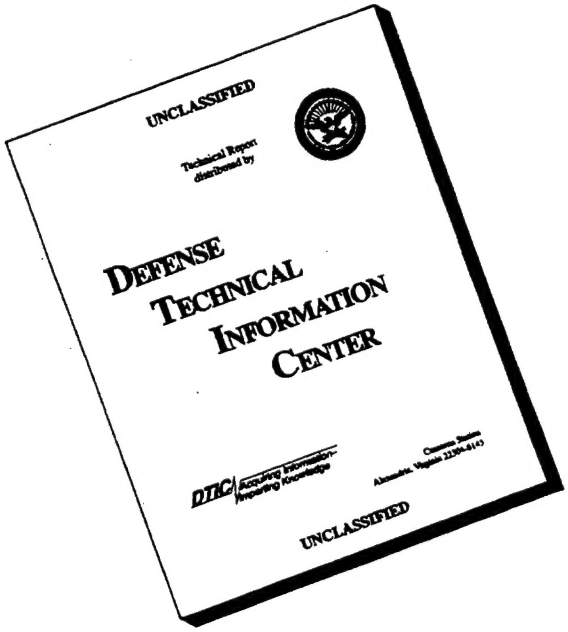

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This study investigates the current and near-term future single channel satellite communications architecture in support of corps and division operations. It identifies considerations that corps and division commanders have when employing space-based communications systems and suggests several possible alternatives to the single channel tactical satellite system. As an attempt to keep pace with the rapid movement on the modern battlefield, the Army has developed the Warfighter Net. The primary mission of the Warfighter Net is to provide the corps and division commanders with an improved command and control system using the single channel tactical satellite system. However, single channel tactical satellite access is extremely restricted, has limited information throughput, and has no anti-jam capability. To determine viability of current and near-term future single channel tactical satellite communications architecture, analysis and comparison of U.S. Army long-haul communications requirements, capabilities and shortfalls are made in the thesis. This study concludes that single channel tactical satellite systems offer many advantages to the force; however, a commander must allocate his assets judiciously and employ alternative means of communications when applicable.

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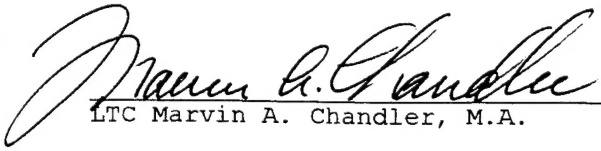

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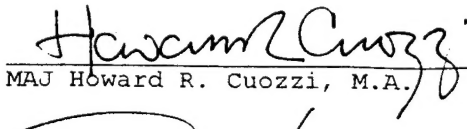

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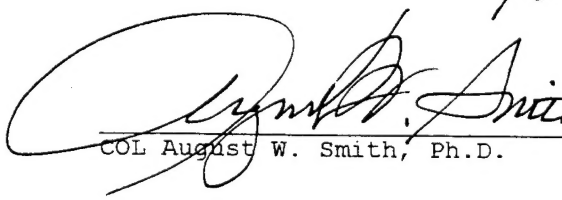

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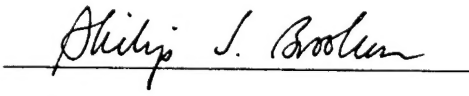

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ABSTRACT

THE EXPLOITATION OF THE SINGLE CHANNEL TACTICAL SATELLITE SYSTEM by MAJ John B. Hildebrand U.S. Army, 61 pages.

This study investigates the current and near-term future single channel satellite communications architecture in support of corps and division operations. It identifies considerations that corps and division commanders have when employing space-based communications systems and suggests several possible alternatives to the single channel tactical satellite system.

As an attempt to keep pace with the rapid movement on the modern battlefield, the Army has developed the Warfighter Net. The primary mission of the Warfighter Net is to provide the corps and division commanders with an improved command and control system using the single channel tactical satellite system. However, single channel tactical satellite access is extremely restricted, has limited information throughput, and has no anti-jam capability. To determine viability of current and near-term future single channel tactical satellite communications architecture, analysis and comparisons of U.S. Army long haul communications requirements, capabilities and shortfalls are made in the thesis.

This study concludes that single channel tactical satellite systems offer many advantages to the force; however, a commander must allocate his assets judiciously and employ alternative means of communications when applicable.

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CHAPTER 1

INTRODUCTION

The purpose of this thesis is to examine the current ultrahigh frequency (UHF) single channel tactical satellite (TACSAT) system. It will ascertain if the TACSAT system can provide adequate communications connectivity to emerging special purpose architecture, yet still support United States Army maneuver commander's requirements as an over-the-horizon command and control system through the twentieth century.

Background

For most of the U.S. Army, UHF TACSAT is a new and reliable means of communicating long distances. However, military forces have employed UHF TACSAT for nearly thirty years.

Activities in satellite applications in the military UHF band (225-400) began in 1967 with the launch of the small Lincoln Laboratory experimental satellite (LES) 5, demonstrating low data rate at 75 bits per second transmission to aircraft, ships, land vehicles, etc. The more powerful LES 6 and Tactical Satellite TACSAT 1 satellites, launched in September 1967 and February 1969, respectively, permitted the technical and operational feasibility experiments to continue on a broader scale and eventually went into use as an interim system. Experience gained with these systems has been incorporated into the concept of the Fleet Satellite Communications System (FLTSAT). The

FLTSAT provides a global UHF relay as the primary transmission medium for beyond the line-of-sight ranges for Navy ships and aircraft. The Air Force segment of the system is called the Air Force Satellite Communications System (AFSAT). In addition to the channels in the FLTSAT satellites, AFSAT terminals use transponders on other host satellites to obtain additional coverage.[1]

Despite the success the Navy and Air Force had with single channel UHF TACSAT during the late 1970s, the Army did not employ man-packed single channel UHF tactical satellite communications until 1980. One possible explanation for this is that the early ground terminal devices were much too large in size and weight. A single channel TACSAT terminal in the mid-1970s would fit inside a small van. It took several visionaries from joint community and Army special operations forces (SOF) to change the way the U.S. Army viewed the exploitation of space-based communications.

During the rehearsals to Operation Eagle Claw, the attempted Iran hostage rescue, communications specialists from the Army and engineers from a commercial electronics company modified USAF line-of-sight radios to work with the Fleet Satellite Communications (FLTSAT) system. These modified radios combined with communications security devices provided man-packed real-time secure voice communications through the FLEETSAT satellite system. Before this time, the only long-haul man-packed radio systems available to the Army were high frequency (HF) radios. During Operation Eagle Claw, secure satellite voice communications were established among the remote airstrip in Iran

(Desert One), Egypt, and the Pentagon. Notwithstanding the failed rescue attempt, the satellite voice communications were a major success.

In 1983, U.S. Forces invaded the island of Grenada in operation Urgent Fury. This was the first substantial military conflict since the Vietnam War. The U.S. Air force (USAF), Navy and special operations forces used UHF TACSAT with mixed results. Problems with frequency interference, communications security keys, and standard operating procedures hindered the effectiveness of the system.

Six years later, U.S. Forces again conducted combat operations. This time it was against General Noriega and the Panamanian Defense Force. In Operation Just Cause, the invasion of Panama, the communications architecture was a major success story, especially when compared with the communication problems of Urgent Fury. In the six years between Urgent Fury and Just Cause, the use of UHF TACSAT grew considerably. The Special Operations Forces (SOF), light and airborne forces of the assault task force, all employed no less than fifty ground terminals and used a dozen satellite channels. UHF TACSAT had become a major piece of the command and control architecture for force projection forces. An example is found in an excerpt of the 7th Infantry Divisions' After-Action Report:

> On 25 December the 50th Signal Battalion provided two URC-101 satellite radios with operators to the 7th Division. Shortly afterwards, it provided a third. The requirement for doing so pointed to a perceived shortcoming in that division's organic equipment for contingency operations. Operation Just Cause spread the 7th Division out between the Panama Canal and the Costa Rican Border, an area of approximately 14,000 square miles dotted with widely dispersed company and platoon-sized elements on "search and clear" missions. With only ten PSC-3 satellite radios for the entire division, JTF-South had to augment their organic communications even to begin to meet the requirement to maintain the

standard of constant and continuous communications to which the American Army has, by and large, grown accustomed.[2]

The 7th Infantry Division submitted the above comment to JTF-South J-6, 10 January 1990, as part of a report, titled, "Long Range C^3 Requirements in a Light Infantry Division." This sentiment was echoed by several other major units that participated in Operation Just Cause.

SOF forces employed no less than ten separate satellite channels and dozens of TACSAT radio systems. The JSOTF commander used UHF TACSAT as the primary transmission medium for his command and control. TACSAT was the only reliable long range C^3 system available to the JSOTF commander to control and coordinate simultaneous assaults throughout the country of Panama. The UHF TACSAT system worked well. The Just Cause single channel C^3 architecture established a model that future SOF communications architectures would be based upon.[3]

The importance of communications satellite support during the Persian Gulf War cannot be overstated. Prior to the Gulf War, U.S. satellite systems were used primarily in contingency operations. In each case, these operations were limited in scope and time and only required a portion of U.S. military space assets. The Persian Gulf brought space based support platforms into the forefront of U.S. Military commands. More than 90 percent of all communications going into Saudi Arabia arrived via satellite.[4]

According to Central Command (CENTCOM) after action reports, at the beginning of Operation Desert Shield, the CENTCOM TACSAT usage was very limited. Once Desert Storm began, TACSAT usage increased over a hundred fold. In excess of 1,200 TACSAT terminals were deployed in theater. The satellite usage requirement was for both inter- and

intra-theater communications. Intra-theater satellite communications were especially important because of the vast operational area in which there did not already exist a communications infrastructure. Another observation was that TACSAT was used extensively for command and control from echelons above corps down through corps and division levels.

When units deployed beyond the line of sight (LOS), frequency modulation (FM) retransmission and line-of-sight relays could not be established. TACSAT played a vital role in the Gulf as made evident by a statement made by the 3d Armored Division Commander, "This communications device (TACSAT) proved indispensable and became our primary means of coordinating our action with 1AD and 1ID to our flanks and the VII Corps Staff."[5]

The reliance on UHF TACSAT is not diminishing with the availability of new high-technological communications systems. In the 82d Airborne Division's potential forced entry of Haiti, Operation Uphold Democracy, the division planned to use only single channel TACSAT and FM radio systems for both internal and external nets for the first twelve hours of the operation.

There were several command and control platforms that comprised the communications backbone during the initial assault phase. These platforms varied from EC-135, Airborne Command and Control Center (ABCCC) and Airborne Warning and Control System (AWACS) aircraft to naval command ships the USS Mt. Whitney and USS Dwight D. Eisenhower. The major systems used to interconnect the platforms were single channel TACSAT and UHF LOS radios.[6]

Scope

The thesis focuses on the UHF single channel, tactical satellite system and how the possible use of the system to support architecture will affect future command and control applications. It identifies considerations a corps or division commander must define when he allocates his TACSAT assets to support the mission. The thesis development provides the latest information on current and future TACSAT systems from the Project Manager for UHF TACSAT at the Department of the Army and the Force Development Branch at Fort Gordon, Georgia.

The research examines current doctrinal and open source material for information related to current and future UHF TACSAT systems and operations. To understand the impact the new UHF TACSAT system will make in future battles, there is a need to understand the capabilities and limitations the new UHF Follow-On (UFO) satellite system and the Demand Assigned Multiple Access (DAMA) system.

Finally, the research analyzes current and projected TACSAT requirements for the Corps and Division Commanders to determine if the UHF TACSAT system can support C^3 in future combat operations adequately.

Significance of the Thesis

The thesis supports commanders and planners in configuring future C^3 systems and establishing priorities to units requesting UHF TACSAT equipment and access to the satellite. As purchasing and distribution of UHF TACSAT terminal continues, demands for access to satellite channels will increase proportionally. Even with the introduction of DAMA terminals, demand for access to the satellite will exceed the channels available.

In particular, UHF TACSAT offers several important characteristics of over-the-horizon communications. These characteristics are availability, mobility, flexibility, timeliness, and survivability. Surprisingly, the problems with access to the UHF TACSAT system faced today were identified twenty years ago. The following excerpt was taken from an article published in *Signal* magazine in 1976.

> Military satellite communications requirements are increasing rapidly. Several practical limitations exist on achievable capacity and survivability. New technology will permit growth, but cost, frequency spectrum limitations and other factors will limit the capability.
>
> The system architecture must necessarily include a continuing requirements analysis and evaluation of alternative considering overall system costs. The evolution from present to follow-on systems will pose a number of transition problems with respect to both the terminal and space segments. Finally, the need to provide adequate system availability may be the most important single influence.[7]

The thesis analyzes current doctrine and policy for employing UHF TACSAT to determine if the Army is heading in the right direction. As technology continues to reshape the battlefield, commanders will find that the geographic scale and the pace of combat operations will continue to increase. The increased scale and pace stretch communications systems to their limits. UHF TACSAT could be the answer for over-the-horizon communications. Unfortunately, not all units will be able to take advantage of the UHF TACSAT system. The most important issue addressed in this thesis is that branches are designing and testing many new special purpose architectures that could employ the UHF TACSAT system as a possible carrier for their information. This may adversely affect the maneuver commanders ability to use the TACSAT as a command and control system. Even with

the Warfighters Net, corps and division commanders will have to decide priorities of access to the TACSAT system: command, operations, intelligence, or logistics.

In an attempt to keep pace with the rapid movement on the modern battlefield, many branches of the Army are designing and testing special purpose architectures to transfer information and maintain battlefield relevancy. Many of these architectures are still in the proof of concept phase but are looking to the UHF TACSAT system to carry the information. The Warfighter Net is currently the only approved single channel TACSAT architecture available to the corps and division commander. The only TACSAT systems available to the corps and division commander are those authorized to support the Warfighter Net.

Primary Research Question

Will limited availability to the TACSAT system leave corps and division commanders without the long-haul communications they require on the battlefield?

Secondary Questions

Several supporting questions affect the primary research question. What are the capabilities and limitations of the current system? How are requests for access currently prioritized and authorized? How does doctrine dictate distribution of UHF TACSAT assets? What are the next generation UHF TACSAT system capabilities and limitations? Whom was the next generation UHF TACSAT system designed to support? What are the similarities and differences

between the current and next-generation UHF TACSAT systems? How will intelligence, administrative, or logistic information be passed in an austere battlefield? What priority will intelligence, logistics, and administrative information have on the Warfighters Net? How will UHF TACSAT be employed under the Force XXI concept?

Key Definitions

a. Force Projection Operations. Force projection is the demonstrated ability to alert rapidly, mobilize, deploy, and operate anywhere in the world. It is a key element of power projection--the ability of the nation to apply all or some elements of national power to act in crisis, to contribute to deterrence, and to enhance regional stability. Power projection is a central element of U.S. national security and national military strategy.[8]

b. Command and Control (C^2). The exercise of command that is the process through which the activities of military forces are directed, coordinated, and controlled to accomplish the mission. This process encompasses the personnel, equipment, communications, facilities, and procedures necessary to gather and analyze information, to plan for what is to be done, and to supervise the execution of operations.[9]

c. Geostationary orbit. The period of revolution of the satellite is equal to the period of revolution of the Earth about its axis. A geosynchronous orbit can be circular or elliptical, and inclined at various angles to the plane of the equator. The geostationary orbit is unique. In addition to being geosynchronous, it is circular and lies in the equatorial plane; the satellite follows the

same direction of rotation as the Earth. At this orbit, the angle of view of the satellite is 18 degrees, covering about 42.3 percent of the Earth's surface. The maximum allowable distance between earth stations is about 11,000 miles.[10]

d. UHF TACSAT Terminal. The lightweight satellite terminal is a tactical LOS/SATCOM/AM/FM multifunction radio suitable for aircraft, vehicles, fixed-station, and man-packed appliques. Operating in the 225-400 megahertz band, most radio systems are now microprocessor controlled. It operates in wideband modes on AM and FM voice and cipher text. Most radio systems have internal modems that operate in a 5 kilohertz narrow band mode at data rates of 1200 bits per second and 2400 bits per second.[11]

e. Demand Assigned Multiple Access (DAMA). DAMA is a method of gaining efficiency in the use of UHF TACSAT channels by automated channel sharing. Demand assigned means that unused transponder space can be reallocated in near real-time on the basis of precedence. This will increase the loading efficiency by providing roughly four-to-twenty times the information throughput of the current systems. A channel is divided by a DAMA control station into segments of time called "time slots." A using terminal interacts with the control station, which allocates time slots for that user's communications. Channel resources are allocated on the basis of current needs and network rankings. Any unused DAMA channel resources are available to be shared by everyone.[12]

f. Warfighter. For the purpose of the thesis, warfighter refers to the maneuver commander at division and corps level.

Limitations

The thesis is unclassified; therefore, classified information is not used in this document. Classified or special access program (SAP) single channel satellite systems or other over-the-horizon communications systems is not addressed in this thesis.

Delimitations

The thesis addresses the capabilities and limitations of current and next-generation UHF TACSAT systems. It then analyzes current and projected requirements to determine if the next-generation UHF TACSAT system will be able to adequately support command and control for maneuver commanders.

Preview of the Study

Chapter 1, Introduction, contains the statement of the research question and the background and context of employment of the spaced based communications systems. It also includes the definition of key operational terms, limitations and delimitations and the significance of the thesis.

Chapter 2, Review of Literature, summarizes and evaluates the exiting information and current research on the thesis subject. More importantly, it found gaps in the current literature that the thesis has attempted to fill.

Chapter 3, Current Single Channel TACSAT Infrastructure, contains definitions of current policies, doctrinal requirements, and systems employed by US forces. The thesis focuses on state-of-the-art

communications which builds on the case for this study. It includes both warfighter and support force TACSAT communications.

Chapter 4, Research Methodology, outlines in detail the specific research methods and techniques applied to this problem. In answering the who, what, where, and why of the problem, the thesis contains an explanation of how the research moved from identification of the problem to a coherent conclusion and sound recommendations.

Chapter 5, Analysis, presents, explains, and analyzes the evidence produced by the thesis methodology. The analysis prepares a sound basis for the thesis conclusions and recommendations.

Chapter 6, Conclusions and Recommendations, states the discoveries that have emerged from the thesis research evidence. It also identifies other possible areas of related topics that require additional study.

Endnotes

[1]Frederick E. Bond and CDR William H. Curry, Jr., USN, The Evolution of Military Satellite Communications Systems. SIGNAL, March 1976, 39-44, Lee M. Paschall, Air and Satellite Communications. AFCEA/SIGNAL MAGAZINE, AFCEA International Press, Washington D.C. 1988, 56.

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CHAPTER 2

REVIEW OF LITERATURE

A great deal of time, energy, and ink have been applied to how the United States Armed Forces should evolve as it heads into twenty-first century. Senior military leaders developed the idea of Force XXI as the course the military will travel as it enters the next century. A lion's share of the writing is dedicated to the information infrastructure to support the idea of Force XXI. Force XXI incorporates new techniques in leader development and training with state-of-the-art equipment. Evolution of the Army under Force XXI requires changes in doctrine and organizational structuring.

The Army of the future is one of small but lethal design. Force projection and extended lines of communications will be normal operations for the force. The communications system designers have developed systems to support extended lines of communications. Unfortunately, the systems designers of UHF TACSAT systems and the forces expecting to use those systems have two different ideas of what the capabilities of the systems will be.

Single channel TACSAT will be no small player in the next generation of warfighting communications systems. The Combat Arms, Combat Support, and Service Support units are developing tactics, techniques, and procedures that aim to exploit the UHF TACSAT system. The thesis identifies possible systemic disconnects between the TACSAT

controllers and the units planning to employ the system. It addresses these problems and identifies several possible solutions only after extensive review of current doctrine, after-action and lessons learned documents and published and unpublished works on the subject matter.

The cornerstone document for the Army satellite communications is "The Army Satellite Communications (SATCOM) Architecture," published by the United States Army Signal Center at Fort Gordon, Georgia, dated January 1996. This document describes the requirements, capabilities, and initiative that shape Army satellite communications. It includes extensive updates on current, transitional and objective programs and architectures. The Army Satellite Architecture manual is published annually.

Communications requirements in support of force projection operations are covered in several field manuals(FM), notably, FM 100-5 and FM 11-32. FM 100-5, Operations, is the Army's keystone war fighting doctrine. It is a guide to commanders on many facets of operations. The writers of FM 100-5 developed this manual from knowledge and wisdom gained from recent conduct of operations and time-tested principles and fundamentals. FM 11-32, Combat Net Radio Operations, provides guidance for using single-channel radios on the modern battlefield. More important, FM 11-32 describes new systems being fielded and provides specific doctrinal uses for each of those systems.

Numerous after-action reports and lessons learned documents describe how UHF TACSAT systems were employed. The reports include combat operations in Iran, Grenada, Panama, and the Persian Gulf, and operations other than war in Somalia, Rwanda, and Haiti.

A review of published and unpublished literature concerning both historical precedents and expected future employment of UHF TACSAT illustrates the absence of a coherent link between what the resource manager can provide and what the consumer expects. Through contacts with the combat developers and TRADOC systems managers for user requirements at Fort Gordon, Georgia, and the project managers of SATCOM and EMUT at Fort Monmouth, New Jersey, this thesis will outline who receives the services and what capabilities are offered.

It presents information on how the Warfighters Net was established, how the particular number of ground terminals were determined and what types of information were expected to be passed through this net. Other information covers how they envision supporting the intelligence, logistics, and administrative TACSAT requirements.

Written work in the field of UHF TACSAT takes two general avenues. One avenue is that of the system designers and managers, attempting to capture and disseminate the capabilities of the new systems. The other avenue is that of the customers reiterating how much more they need from the UHF TACSAT system. Unfortunately, there appears to be a major disparity between the two parties.

The thesis helps to fill the void between the system designer and the customer. It defines capabilities in layman's terms and templates the capabilities and limitations over the user's requirements.

CHAPTER 3

CURRENT SINGLE CHANNEL TACSAT INFRASTRUCTURE

Introduction

This chapter defines the current policies, doctrinal requirements and systems employed by U.S. forces. It also includes short and near-term architectural developed by the Army that will impact the UHF TACSAT system. The focus is on state-of-the-art TACSAT communications which directly build on the case for this study.

Policies

National and Department of Defense space policies state that the primary goal of space activity is to ensure the security of the United States. These policies focus on the operational capabilities that enable the military to fulfill national security objectives.

Army space policy supports national and DOD policies, articulates the Army's position, and serves as a framework for the Army's future direction in space. The Army's space objectives include:

1. To capitalize on emerging space capabilities.

2. Exploit space activities that contribute to the successful execution of the Army mission.

3. Support assured access to space and use space capabilities to aid strategic, operational, and tactical missions.[1]

Accordingly, the Army has established the following basic tenets to

guide near and mid term space activities and long range space planning:

1. Space is integral to all Army operations.

2. Space related technologies will improve Army Capabilities.

3. Space support to Army forces will increase.

4. The Army will be assigned more space-related missions.

5. The Army will continue to exploit commercial capabilities.

As stated in the Army SATCOM Architecture manual dated January 96, the Army Enterprise Strategy is the single, unified vision for the Army Command, Control, Communications, Computers, and Intelligence (C^4I) community. The purpose of this strategy is to support United States Army warfighers into the 21st century. The Army must integrate both current doctrine and force modernization plans, hence the Enterprise Strategy is the way the Army intends to win the information war on the next battlefield. The ten principles of the Army Enterprise Strategy as noted in the U.S. Army Space Operations Concept includes:

1. Focus on the Warfighter: Provide the war fighter the systems that meet validated needs.

2. Ensure joint interoperability: Provide the warfighter C^4I systems that interoperate in joint and combined operations.

3. Capitalize on space-based assets: Provide the warfighter assured access to mission -essential military and commercial space-based systems that support the Force Projection Army across the entire operational continuum.

4. Digitize the battlefield: Provide the warfighter an integrated digital information network that supports warfighting systems and assures C^2 decision-cycle superiority.

5. Modernize power projection platforms: Provide the warfighter a modern power projection platform to support peacetime operations, training, mobilization, force projection, split-based operations, and redeployment.

6. Optimize the information technology environment: Provide the warfighter more efficient information support for combat and peacetime operations.

7. Implement multi-level security: Provide the warfighter the ability to access and exchange information at needed levels of classification using a single C^4I system.

8. Ensure spectrum supremacy: Provide the warfighter electromagnetic spectrum supremacy in order to maximize the benefits of maneuver and tempo in conjunction with firepower.

9. Acquire integrated systems using commercial technology: Provide the warfighter synchronized C^4I capabilities that leverage commercial technology.

10. Exploit modeling and simulation: Provide the warfighter with cost effective training, testing, and rapid prototyping through state-of-the-art modeling and simulation.[3]

The thesis has outlined the Enterprise Strategy which identifies the way the Army intends on winning the information war on the next battlefield. The Army SATCOM mission dictates how the plans to exploit space to win the next war.

The Army SATCOM Mission

> The Army envisions increased use of space-based assets to provide global connectivity while enhancing tactical operations. Space capabilities are a vital and integral component of each of the Army's strategic roles and are important "force multipliers" for operational and tactical missions. Satellites on orbit are mission-ready and quite responsive to user requirements world-wide. The Army can use satellites to receive and distribute timely information to the ground commander that can reduce the level of uncertainty about a given situation without revealing interest or intent. The worldwide presence of space systems enhances stability by permitting the United States and its allies

> to see the area of operations and provide early warning of activities adverse to United States interests. This information can be used to support both combat and peace operations, humanitarian assistance, and operations in aid of civil authorities.[4]

Current TACSAT Requirements

TACSAT architecture is designed to support the warfighter. No two warfighters are the same, nor are any two regions of the world the same. The communications requirements for forward deployed forces are considerably different than those of contingency forces. Communications requirements also vary greatly between combat operations and military operations conducted in situations other than war.

The TACSAT architecture must be flexible enough to overcome the different challenges and fulfill the specific requirements of any particular area of operation. The system must be dynamic enough to support military operations throughout the conflict continuum. Satellite repositioning, terminal mobility, frequency selection, and system resource allocations represent different options allowing the user and system manger flexibility in responding to rapidly changing operations, threats, and geographic needs.

Since the Army no longer fights unilaterally, the architecture must be interoperable with the sister services and allied nations. The TACSAT link is one of many links in the Infosphere. It must be easily interfaced with the terrestrial-based systems. Commonality among ground terminals will also support complete interoperability.

In order for the United States to project its military power to any area of conflict or concern, the architecture must provide global coverage. The warfighter must be able to establish reliable TACSAT

communications from any location in the world, to include the polar regions. Warfighters need TACSAT to support continuous operations worldwide, and to accommodate, simultaneously, widely dispersed forces in various stages of employment. This becomes even more critical when employing the concept of split-based operations. Split basing maximizes airlift and power projection by deploying the warfighters into the conflict area while maintaining the lion share of the support base in CONUS or a forward staging base.

The final requirement is for assured access. The Army must have assured access to space resources in order to fulfill its mission. Warfighters need assured access to TACSAT services to exercise positive command and control and to disseminate intelligence during all operational phases. Assured, real-time access to satellite communications allows the warfighter to collect and disseminate intelligence and execute orders rapidly enough to operate before the enemy can react.[5]

As stated above, the Army has a valid requirement for UHF TACSAT. Because it is dynamic, flexible, and reliable the Army developed a concept for employing UHF TACSAT.

Army Concept For Use of UHF TACSAT

The Army uses UHF TACSAT for its single channel communications. It supports mobile, tactical forces. The Army Warfighter Net is an example of a single channel TACSAT net. It was designed as a Corps and Division Commander TACSAT net that uses only UHF satellite communications. UHF has the advantage of low cost, user terminals that are small and light weight and can operate well with small, portable antennas.

It can be used, on-the-move under adverse weather conditions, and in dense foliage. On the other hand, UHF TACSAT is hampered by

its narrow bandwidth which yields low data rates and is easily susceptible to both detection and jamming.

The single channel TACSAT provides worldwide tactical communications such as enroute contingency communications, in-theater communications, intelligence broadcast, and Combat Net Radio (CNR) rage extension. TACSAT radios link tactical operations centers to all echelons corps and below and includes the Long Range Surveillance Units (LRSU) and Army Special Operations Forces (ARSOF) units. These units can be separated hundreds of miles away form the main forces.

For many Army missions, the use of small portable TACSAT terminals for long haul communications is extremely beneficial to a warfighter already overloaded with a variety of life support gear. In the near term, the Army plans to acquire receivers to take advantage of currently deployed space systems and leverage extensively off of commercial technology. In the future, the Army, together with other services, will define requirements which will lead to specific designs of space systems. To gain the advantages for the future, appropriate actions must be undertaken by the Army now to ensure that the desired outcomes are reached.[6]

Current Space Segment for the TACSAT System

The space segment for single channel TACSAT uses a variety of space platforms divided into separate and dissimilar constellations. The space segments use the UHF radio frequency as a carrier wave, operating in the electromagnetic spectrum between 225 megahertz and 400 megahertz. A frequency plan has been devised to control each space segment in an effort to reduce interference between adjacent satellites.

There are four different space constellations on which UHF is available worldwide to Army users: the Fleet Satellite Communications System (FLTSAT), a Gapfiller Constellation, a leased satellite constellation (LEASAT), and the most recent addition, the UHF Follow-on (UFO) system. These constellations support the single channel TACSAT mission and constitute thirteen orbiting platforms. All the above

mentioned assets with the exception of the UFO constellation are nearing or have already exceeded their expected design lives. The UFO system is in the process of being deployed and is expected to carry the TACSAT mission into the twenty-first Century. The operational capability of the UFO is eight orbiting satellites and is expected to be in full operation by 1997.[7]

The FLTSAT is a UHF/EHF military satellite communications system shared by the Navy, Air Force, and Department of Defense. The FLTSAT has four primary and a number of spare satellites in geosynchronous orbit. The system maintains latitudinal coverage of 70 degrees north to 70 degrees south. Each FLTSAT satellite provides twenty-three UHF Channels as follows:

1. One SHF anti-jam uplink/UHF downlink one-way fleet broadcast 25 Kilohertz channel which provides 15 time division multichannel 100 word per minute teletype circuits. This channel is different form the others. It receives fleet broadcast at SHF, performs on-board processing, and downlinks at UHF.

2. One 500 kilohertz UHF channel. DoD wideband capable of 14 simultaneous teletype channels or voice channels for use by JCS.

3. Nine 25 kilohertz channels for ship-to-ship, ship-to-shore, shore-to-ship and patrol air craft-to-ship voice or data transmissions.

4. Twelve 5 kilohertz UHF Air Force controlled channels for 75 bits per second teletype and repeater service. One channel provides a system orderwire for coordination and control of users.

The one 500 kilohertz channel and the nine 25 Kilohertz-only channels are independent of each other. The failure of one does not

affect the others. The Army may request access to the nine fleet relay channels, the twelve 5 kilohertz channels and the 500 kilohertz channel.[8] The UFO system will replace the FLTSAT system.

The LEASAT system is a fallout of the a 1977 congressional directive to increase the use of leased commercial systems. The LEASATs are commercial satellites which are leased by the Navy and provide service similar to those on the FLTSAT satellite. They each provide five 5 kilohertz channels, seven 25 kilohertz channels and one 500 kilohertz channel. The LEASATs are located near the FLTSAT satellites to provide additional capacity and share the overall frequency plan. Army users may request access to two 25 kilohertz channels, five 5 kilohertz channels and limited access on the 500 kilohertz channel.[9]

The Gapfiller satellites were launched to fill the void between the FLTSAT system and its predecessor, the original TACSAT system. The Gapfillers' capabilities include two 25 kilohertz channels and one 500 kilohertz channel. These satellites are still functioning today and support a small portion of the TACSAT mission.[10]

There are two remaining UHF satellite assets available to the warfighter, the Air Force Satellite Communications System (AFSAT) and the Lincoln Experimental Satellites (LES). These systems have peculiar characteristics that make them less desirable to the warfighter.

The AFSAT system does not have its own separate satellites but are packages aboard other geosynchronous orbiters. There are twelve 5 kilohertz channels which are independent of other communications on their host satellites. There is also a 500 kilohertz channel to

support CONUS, the Atlantic and Pacific regions, and a CONUS LEASAT.[11]

MIT Lincoln Labs built and maintains the LES-8 and LES-9 satellites. These satellites were launched in 1976 as test platforms and are still active today. The unusual nature of these two satellites is that their orbit extends 18 degrees north and south of the Earth's equator. This allows the LES-8 and LES-9 to provide TACSAT communications to the Arctic and Antarctic regions for several hours each day.

The final space segment single channel satellite asset available to the warfighter is that provided by the International Maritime Satellite Organization (INMARSAT). INMARSAT is an international satellite consortium consisting of 68 member nations that provides telephone, telex, data and facsimile services around the world. Originally created to operate a global maritime communications system for distress and other maritime traffic, INMARSAT has expanded considerably to include land mobile and aeronautical user terminals. The INMARSAT system operates with small, low-power user terminals communicating to large coastal earth stations that provide a gateway to terrestrial based networks.[12]

Army TACSAT Access

All Military Satellite Communications (MILSATCOM) systems are designated as joint assets to be controlled by the Chairman, Joint Chiefs of Staff (CJCS). These SATCOM assets are allocated on a priority basis. Priorities are established by the CJCS and are briefly outlined as follows:

1. Priority 1: Top priority for MILSATCOM access is reserved

for the National Command Authority; strategic warning and intelligence, and Single Integrated Operations Plan (SIOP)(nuclear).

2.Priority 2: Second priority goes to State Department, CJCS, CINCs, Joint/Combined Task Force (J/CTF), and CINC component commands.

3. Priority 3: Third priority is given to essential support, such as weather, logistics, diplomatic post support, and MIJI support.

4. Priority 4: Fourth priority is given to joint exercises, service exercises, and other training.[13]

In line with the JCS directive that the TACSAT system is an operational net, the CJCS has apportioned the spaced based TACSAT assets geographically to the CINCs. The CINCs in-turn apportions out those resources to the J/CTC or component commands, depending on national priorities.

Historically the Army has deployed into an area of operations with its own organic TACSAT communications but with the increased demand of the TACSAT system, access to the system is much more restrictive. The Army user responsible for getting access to the UHF TACSAT system must have four approvals prior to requesting access:

1. A validated Integrated Communications Data Base number.
2. An approved ground terminal.
3. The supported CINC's approval and priority.
4. Area Frequency Clearance.

Even after gaining initial approval for access to the system, low priority users always run the risk of losing the assets to a higher priority.

Current Ground Terminals for the TACSAT System

The warfighter employs several variations of authorized ground terminals. These terminals operate on the UHF frequency band and can be used in vehicle or man-packed configuration. The TACSAT ground terminals operate on either 5 kilohertz or 25 kilohertz. The advantages of the TACSAT ground terminals are that they are lightweight, simple to operate, reliable, and durable.

The disadvantage is that they lack anti-jam capability, but the most notable draw-back is the difficulty obtaining access to the space segment. All systems are battery operated and/or alternating current (AC) powered single channel, half duplex UHF TACSAT transceivers. The ground terminals operate at frequencies between 225-400 megahertz. The warfighter's most commonly used ground terminals include:

The AN/PSC-3 is a man-portable, self-contained transceiver. It has four transmit and four receive channels. Accessories include a battery pack, a 110/220V AC power adapter, a small helical SATCOM antenna to transmit to and receive traffic. It also has a whip antenna for SATCOM reception while moving, or ground line-of-sight transmission. The weight of the PSC-3 with all accessories is about thirty pounds. The weight of the transceiver alone is fifteen pounds.

It was designed for Special Forces, Ranger units and Infantry units providing voice communications at 300, 1200, and 2400 bits per second over a 25 kilohertz channel. To transmit and receive secure information, a TSEC/KY-57 must be connected externally to the transceiver. The AN/VSC-7 is the vehicular version of the PSC-3. The Army currently maintains approximately 117 VSC-7s in its inventory.[14]

The HST-4A/C is a lightweight, compact ground terminal. It has a built-in modem that operates at 1200 or 2400 bps data capability. There are five channel, one manual and four preset. The transceiver weighs approximately 9 pounds and is compatible with all other ground terminal systems of the single channel TACSAT family. To transmit and receive secure information, a TSEC/KY-57 must be connect externally to the transceiver.

The AN/PSC-7 (or MST 20+) is an improved version of the HST-4. It is manportable but not militarized. It has five preset transmit and receive frequencies. It weights seven pounds without batteries or accessories. The AN/PSC-7 was purchased in 1992 by the Army for use in the Corps and Division warfighter nets.

The Army currently maintains 480 terminals for the warfighter net and 227 terminals dedicated for Special Forces. The PSC-7 is not DAMA capable.

The MISTE II terminals are also a version of the HST-4 family. It is a lightweight totally integrated, secure UHF TACSAT terminal fitted in a standard 5-inch briefcase. It is primarily used covertly in urban terrain and can be fully assembled in less than ten minutes. The MISTE II briefcase weighs approximately thirty-two pounds.[15]

The LST 5 B/C is a lightweight satellite and LOS terminal which is microprocessor controlled and has an Erasable Programmable Read Only Memory (EPROM). This terminal is currently being used in manpacked, vehicular, airborne, shipboard, remote and fixed station. Four push buttons control all modes of operations, frequencies, bands, and pre-sets. To transmit and receive secure information, a TSEC/KY-57 must be

connect externally to the transceiver.[16]

The AN/PSC-5 Enhanced Manpack UHF Terminal (EMUT) is a lightweight single channel TACSAT terminal that supports communications at all echelons. This terminal is non-developmental (NDI) and includes embedded COMSEC, narrowband voice, five and twenty-five kilohertz DAMA as well as LOS communications for voice and data. The EMUT is the DoD choice to replace all UHF manportable and vehicular TACSAT transceivers. There are 6000 total terminals being purchased and specific Army requirements are still being formulated.[17]

TACSAT Communications Support of Force Projection Operations

A force projection army relies heavily on its communications. To support force projection the communications must be aligned to the commander's tactical plan. The TACSAT plan will follow the phases of force deployment contingency operations. The Architecture must provide connectivity with all major elements through all phases.

Phase 1: Predeployment: The Corps and Division identify TACSAT access requirements and the respective commanders prioritize those requirements. Detailed communications plans are developed and equipment is identified to support the requirements.

Phase 2: Deployment/initial combat: the Corps Signal Brigade and Division Signal Battalion install single channel TACSAT with hatchmount antennas to deploying troop airframes. During this phase, commanders are required to enter specified TACSAT nets. The tactical plan will dictate what TACSAT nets are to be established. Examples are command, operations, intelligence, administrative and logistical nets.

Phase 3: Force build up: The first communications build-up in an objective area arrives with the first combat forces on the ground. As forces flow in, the communications architecture expands to meet the requirements. As a location is developed, the communications infrastructure begins to rely more heavily on the multichannel systems and Area Common User System (ACU) and less on TACSAT and LOS Combat Net Radios (CNR).

Phase 4: Decisive combat: As forces begin to rapidly move across the battle field, commanders again begin to rely on single channel TACSAT, CNR and to a lesser extent, the ACU. The forces conducting rapidly moving deep offensive operations are limited primarily to their single channel communications systems because they will most likely outrun their multichannel systems and the Remote Access Units (RAU) to the ACU. The Warfighter Net was developed for this purpose as a result of lessons learned during Operations Desert Storm.[18]

Phase 5: Redeployment: Reliance again shifts to single channels communications systems as the communications infrastructure is disassembled and redeployed to home station. Both military and commercial single channeled SATCOM are used to provide long-haul strategic communications in support of redeploying forces. Whenever possible, forces may transition to commercial communication systems to free up critical tactical contingency communications in preparation for the next crisis.

Current Doctrinal Architecture

The commanders at the Corps and Division use the Warfighters Net as the primary single channel TACSAT command and control net. It provides the commander the capability to tactically control, conduct combat coordination, tactical data transfer and reporting of combat forces. It is a real-time link to long range surveillance units, support units such as the Corp and Division support commands (COSCOM, DISCOM), and engineer units. The Warfighters Net incorporates Corps and Division UHF TACSAT terminals as well as SINCGARS radios (for retransmissions capability).

The Warfighters Net ground terminal is the AN/PSC-7 radio and is distributed throughout the Corps and Division: 38 terminals to the Corps, 24 terminals to a heavy division and 22 terminals to a light division. The commanders are responsible for establishing priorities of distribution of terminals. The intent of the Warfighters Net is that only subordinate commanders and command posts receive the terminals, however, the commander can dictate the distribution in accordance with his battle plan. Flexibility and mobility are designed into the architecture.

The Warfighters Net requires considerable control and management. It can support up to thirty-eight users on one satellite segment. The Integrated Systems Command and Control (ISYSCON) will plan Warfighter Network command and control missions in coordination with Corps and Division staff. This planning includes the identification of TACSAT ground terminals and the SINCGARS retransmission locations. These systems ensure communications on-the-

move between the Corps and Division Commander and subordinate units throughout the AOR.

Special Purpose Architectures

With the ever increasing speed that information flows into and around the battlefield, many branches are scrambling to develop architectures to connect their respective information to the maneuver commanders. The following is a list of developing architectures; it is not intended to be all inclusive, but is intended to offer an idea of the types of architectures being developed.

The Military Intelligence (MI) community is in the forefront of identifying and articulating requirements to gain access to the TACSAT system. The MI requires the capability to rapidly deploy to support force projection commanders anywhere in the world. Satellite communications are critically important in accomplishing this mission. These systems have to support missions that require timeliness and multi-level security. Often times these systems must be stove piped from the Rear to the theater of operations.

The type and quantity of information the MI community transmits to the commander often requires more bandwidth than that which can be supported by UHF TACSAT. UHF TACSAT however, plays a major role in supporting battlefield dissemination throughout the theater of operations. In combination with the Super High Frequency (SHF) multichannel systems, the Area Common User System (ACUS) and MI unique systems, TACSAT provides information intelligence products to the division command posts and maneuver brigades.

Another primary role the TACSAT fulfills is that of the communications link between Corps Headquarters and the Long Range Reconnaissance Detachment (LRSD). The LRSD normally operates well forward of the FEBA and out of ACUS connectivity. The TACSAT systems provide the LRSD teams with voice and data communications that are stealthy and secure and also maintain a low probability of intercept and detection.[19]

The Combat Service Support (CSS) branches also have ongoing requirements for UHF TACSAT. There are many Army missions that CSS supports through a combination of single channel and multichannel satellite systems. Some of the missions these architectures support have requirements for rapid deploy ability, timeliness, lightweight and secure which are not met by any other system than TACSAT.

One such system that is currently under development is the In-Transit Visibility (ITV) initiative. The ITV provides the managers of a multifunctional logistics system with the capability to know the status, location, condition, destination and ownership of items under their responsibility. This system uses the Global Position System to identify its location then relays that information the UHF TACSAT system.[20]

Combat Support and Service Support branches are also currently developing other architectures in an effort to maintain command and control of their respective units throughout the length and breadth of the battlefield. The Engineers, Military Police, Ordinance, Public Affairs and Health Services all articulate requirements that necessitate access to the TACSAT system.

UHF TACSAT Initiatives

The United States Army is currently developing concepts, plans and programs which one based on or in addition to the current UHF TACSAT system. The thesis will examine several of the more significant initiatives and briefly define them in the following paragraphs.

SATCOM Paging: Satellite paging is one endeavor to overcome line-of-sight communications limitations and the inability of many TACSAT ground terminals when communicating on-the-move. This paging system could provide worldwide coverage. Commanders could contact warfighters whose primary communications are disadvantaged by terrain features, distance, or inability to pause and establish TACSAT communications. Tactical satellite paging systems will provide communications security and antispoofing advantages that current commercial satellite pagers can not offer.[21]

Personal Communications Systems(PCS): The PCS uses wireless low level power transceivers to transmit encrypted speech, data, video and mixed speech/data/video/short messages. The tactical PCS is an initiative that many commercial industries are exploring. Some of the more popular initiatives are Loral's Globalstar, Motorola's Iridium, and TRW's Odyssey. There are many variations in each of the systems including size of the ground terminal, anti-jam, low probability of detection and intercept, and satellite altitudes.

Several other capabilities the PCS offers the warfighters are complete interoperabilty with commercial cellular and space-based cellular systems, position location and reporting information, full mobility and connectivity to base stations with no towers, and

predefined networks established on demand using two-button dialing. The size, flexibility and mobility that tactical PCS could potentially offer to the warfighter is exceptional.[22]

Extremely High Frequency SATCOM System: The Secure Mobile Anti-jam Reliable Tactical terminal (SMART-T) is a HMMWV mounted, EHF terminal that provide multichannel range extension for Mobile Subscriber Equipment (MSE) at division and corps over the MILSTAR satellite constellation. It can operate over EHF packages on the FLTSAT and UFO constellations. The SMART-T has a role-on and role-off mobile capability to keep pace with the supported units. The SMART-T is scheduled for fielding in late 1999. The Army is scheduled to receive 209 SMART-Ts by the year 2003.[23]

The Single Channel Anti-jam Manportable Terminal (SCAMP) is designed to interface with the MILSTAR satellite system. It will also operate over EHF packages on FLTSAT and UFO constellations. The ground terminal will operate in a point to point providing voice and data traffic at a maximum rate of 2.4 kilobits. The SCAMP will initially be issued at a manportable package weighing approximately thirty-seven pounds. The next version of SCAMP will be manpacked weighing approximately twelve to fifteen pounds. The SCAMP will be user owned and operated with a setup time of less then ten minutes.[24]

Demand Assigned Multiple Access (DAMA): DAMA is a method of gaining efficiency in the in the use of UHF TACSAT channels by automated channel sharing. simply stated, TACSAT channels are divided by a DAMA control station into segments of time. A user terminal interacts with the control station, which allocates time slots for that

user's communications. Channel resources are allocated on the basis of current needs and network rankings. Any unused DAMA channel resources are available for everyone to share.

Limitations to Access

There are factors external to the Army that limit a corps or division commanders access to the TACSAT system. A detailed account of these limitations was beyond the scope of the thesis, but a cursory look at each of the external limitations is appropriate.

Geography plays a major role in limiting the access. To ensure that the communications satellite remains in geosynchronous orbit, it must maintain an approximate altitude of 22,300 miles over the earth's equator. As was mentioned earlier in this chapter, this positioning of one satellite offers a footprint of approximately 11,000 miles from one fringe to the other. The satellites are stationed equidistant along the equator to provide full earth coverage. This physically accounts for the limited number of satellites any one nation can place along the equator to maintain a geosynchronous orbit.

Once a satellite is identified that maintains a footprint supporting the target area, other limiting factors become obvious. The physical size and channel capacity limits units requesting access to the TACSAT system. Users with higher priority to the system preempt tactical users of the system. Agencies typically maintaining priority are the National Command Authority, Joint and Combined Nets, sister services, and Special Operations Forces.

Requesting and receiving access to the TACSAT system is a long and arduous process. Even after receiving access permission to the

TACSAT system, the controlling authorities may preempt access at any time and have not responsibility to replace the access with an acceptable replacement channel.

Endnotes

[1]U.S. Army Satellite Communications (SATCOM) Architecture, Fort Gordon, Ga, U.S. Army Signal Center, January 1996, pp 1-8.

[2]Ibid., 1-8.

[3]Ibid., 1-10,1-11

[4]Ibid., 1-6

[5]Ibid., 2-2,2-3

[6]Ibid., 3-2

[7]Ibid., 3-3

[8]Ibid., 3-4

[9]Ibid., 3-5

[10]Ibid., 3-7

[11]Ibid., 3-5

[12]Ibid., 8-4

[13]Ibid., 1-3

[14]Ibid., 3-9

[15]Ibid., 3-10

[16]Ibid., 3-10

[17]Ibid., 3-11

[18]Ibid., 5-7

[19]SATCOM Support to IEW SATCOM Development, briefing papers, February 94

[20]U.S. Army Satellite Architecture Report, Fort Gordon Georgia, U.S. Signal Center, December 1993

[21]U.S. Army Satellite Communications (SATCOM) Architecture, Fort Gordon Ga, U.S. Army Signal Center, January 1996, 9-2

[22]Ibid., 9-3

[23]Ibid., 9-9

[24]Ibid., 10-13

CHAPTER 4

RESEARCH METHODOLOGY

Introduction

The thesis defines the primary research question and a series of secondary questions that, when answered will support this and subsequent thesis conclusions. The research methodology establishes a logical method of collecting, organizing, and analyzing pertinent information.

Collection Methodology

The thesis research design provides the basic format needed to conduct this research. The research design identifies the who, what, where, when, and how to evaluate the research question. The thesis identifies what a commander must consider when developing and employing a Warfighter Net in the current and near-future TACSAT architecture.

Primary Research Question: Will limited availability to the TACSAT system leave corps and division commanders without the long-haul communications they require on the battlefield? As an attempt to keep pace with the rapid movement on the modern battlefield, many branches of the Army are designing and testing special purpose architectures to transfer information and maintain battlefield relevancy. Many of these architectures are still in the proof of concept phase but are looking to the UHF TACSAT system to carry the information. The Warfighter Net is currently the only approved single channel TACSAT architecture available

to the Army corps and division commander. The only TACSAT terminals available to the corps and division commander are those authorized to support the Warfighter Net.

The personnel that provide the most current information concerning the thesis research question was the staff working in the Director of Combat Development (DCD) at Fort Gordon, Georgia. DCD provided the most current doctrine, information papers, staff studies and insight on the UHF TACSAT system. Other individuals that contributed to the thesis included signal officers from both corps and division level staffs and project managers for PM SATCOM and PM EMUT.

The thesis researches the most current information dealing with SATCOM communications. This information includes review of current Army doctrine, resent lessons learned, and after-action reports, official military publications, and non-Department of Defense publications. The research entails reviewing space applications, ground terminal equipment and personnel/units expecting to have access to the UHF TACSAT system. Research information includes not only include UHF TACSAT but also other systems that may directly influence on the future use of UHF TACSAT.

Fort Gordon, Georgia, the home of the United States Army Signal Center (USASC), is the Army proponent for space-based communications systems. The DCD at USASC is the working directorate on UHF TACSAT.

The thesis uses the most current information available at the time of its publication. Information that is still in draft form but expected to be published is used in the research analysis.

Research for information pertinent to the thesis was gathered through review of current Army doctrine, resent lessons learned and

after action reports, official military publications, and non-Department of Defense publications. I passed informational requests to and received answers via the telephone system, U.S. Postal system, E-Mail and personal interviews.

Analysis Methodology

The thesis structures the analysis and conclusions to delineate possible employment consideration a corps or division commander must think through to employ his TACSAT assets best. After collecting and collating the most current information about the thesis question, the thesis then analyzes the information to decide what considerations a commander should take into account when allocating single channel TACSAT assets to his division and corps. The criteria apply to the information for analysis is distance and mobility.

The thesis defines distance as the separation between forces on a linear battlefield. An example is a reconnaissance element fifteen miles forward of a Corps main headquarters. It defines mobility as the physical weight, size and shape of the ground terminal. It also includes the assembly and disassembly times to establish communications. Timeliness of the transmission is also a major consideration of mobility.

The thesis uses the offensive, defensive, and retrograde operations to set the environment as a logical approach to identifying how a commander may best employ his TACSAT assets. It templates the criteria over the considerations to detect limitations and capabilities of TACSAT employment during Corps and Division operations.

After applying the data to the research criteria the thesis has identifies possible architectures that a commander may best employ his single channel tactical satellite assets.

CHAPTER 5

ANALYSIS

Introduction

Corps battles are the key to tactical and operational success. The commander's leadership is that element of combat power that molds the corps into a cohesive entity capable of winning battles and communications systems are what links the commander to his subordinate commanders and staff. How he organizes and employs his communication could determine success or failure on the battlefield.

The command and control system for a corps and division enables the commander to set priorities and allocate assets to employ and sustain combat power. If the only concern of a commander was to synchronize his main effort or main and supporting attack, allocation of assets would be straight forward. However, a commander must analyze his situation and determine where to best employ his TACSAT assets. He may decide that an Engineer unit conducting river crossing operations or a Combat Service Support unit hauling much needed supplies should have priority to organic TACSAT assets. Having a flexible TACSAT architecture gives the commander a redundant and survivable tool to synchronize the corps or division combat operations. It also allows the commander a clearer sense of the battlefield and the ability to transmit orders to subordinates in order to adjust to a quickly changing environment.

This chapter identifies considerations that commanders should use when allocating TACSAT assets within his corps or division. Single channel tactical satellite ground terminals available to the commander under the Warfighter Net architecture are thirty-eight terminals at a corps, twenty-four terminals in a heavy division and twenty-two terminals in a light division. An example of a Division Warfighter Net is at page 58 and a Corps Warfighter Net is at page 59. To give the reader a logical flow, the thesis divides the information into TACSAT considerations when conducting offensive operations, defensive operations and retrograde operations.

Offensive Operations

In conducting offensive operations, planners use five complementary elements; deep, close, rear, security/reconnaissance and reserve. The thesis analyses the TACSAT considerations using the battlefield framework of deep operations, reconnaissance, close operations, and rear operations. I included the remaining complements of reserve and security with close operations for this study. For the purpose of this study, deep operations are defined as operations in areas of the offensive zone to support the main attack that engages enemy units not in direct contact with the main force. Close operations are defined as operations with main and supporting attacks as required. Rear operations are defined as operations to sustain offensive momentum and defensive stability.

Offensive Deep Operations

The primary focus of the offensive deep operations is to interdict by delaying, disrupting, or diverting enemy reserves, then shifts to enemy units defending in the second echelon positions. Commanders conduct deep operations as an economy of force operation that allows for the destruction of uncommitted forces that could influence the outcome of friendly close offensive operations.[1] The means for conducting deep operations include field artillery, attack aviation, and mounted and dismounted infantry.

When analyzing TACSAT considerations to support deep operations, the commander must first identify his command and control requirements. He must consider if there is a requirement to maintain contact with the force conducting the deep operations for the duration of the mission.

The force may require intelligence updates enroute to the target area or updates on target priorities. The deep force may be looking in an engagement area for massing of forces or require guidance to the specific areas at a designated time. An example would be the SCUD hunting in the Persian Gulf War. At the time of launching the deep attack the exact locations of the scuds were unknown but by exploiting national intelligence assets, the tactical operations center identified possible Scud locations and then issued terminal guidance to the force.

The commander may require that the deep force provide the corps or division with updated intelligence enroute to the target area. He may require that they identify troop concentrations or special weapons employed by the enemy force. The deep force may have to report on

disposition of river crossings or battle damage assessment for a previous mission.

A commander must also consider the human terrain when he employs a deep attack and what impact that would have on command and control. The Rules of Engagement (ROE) may dictate we accept that minimal collateral damage and protection of civilian population is paramount. The deep force may encounter the enemy using human shields to protect its command and control or weapons facilities or masses of refugees blocking the target area. They may require clarification to the situation in reference to the ROE so a continuous and reliable communications link between the corps and division commander and the deep force commander is required.

Another consideration is if the corps or division provides is own combat search and rescue (CSAR). In deep operations, line-of-sight radio systems are of little value for call in emergency exfiltration or medical evacuation. TACSAT may be the only reliable means of communications for over the horizon CSAR.

Reconnaissance Operations

Reconnaissance operations provide intelligence on the terrain and enemy to the Corps and Division Commander. Reconnaissance verifies or refutes analyzed information in the Intelligence Preparation of the Battlefield (IPB) products. Reconnaissance may be mounted, dismounted, aerial or a combination of all these actions. The Long Range Surveillance Detachment could perform these missions at corps or maneuver elements at division and below. Reconnaissance elements employ

stealth, infiltration, movement, observation and special equipment to obtain information throughout the division and corps areas.[2]

When employing TACSAT to support reconnaissance operations, the corps or division commander considers deployability verses reliability. He decides if the information the reconnaissance elements are sent out to retrieve warrant using TACSAT assets or could other less critical assets be employed without degrading the mission. If the information is time sensitive, a commander may choose to use TACSAT. If the information is not as time critical, he may decide to use high frequency (HF) data burst systems.

Other considerations include identifying what type of force is conducting the reconnaissance. If a mounted, highly mobile force is conducting the mission then assembly and disassembly of the system become critical. The force may have to stop for a length of time to establish communications and wait for a reply. If the commander employs a dismounted force then size and weight become a factor. The amount limits light forces of communications equipment they can transport. If aerial assets are employed then hardware configurations become factors. The airframes may have fixed TACSAT antenna systems or may require strap on systems. The aerial reconnaissance elements may require a command and control platform to accompany the flight or they may require that an intermediate ground station relay information to the headquarters.

One final consideration is if stealth is paramount, then the commander should not employ TACSAT. The downlink of a TACSAT is easily direction found (DF) to the transmitter location. An HF system with low probability of intercept (LPI), low probability of detection (LPD) and

automatic link establishment (ALE) may be a better choice for the mission.

Close Operations

Close operations normally involve a main and a supporting attack. The main attack seizes the corps or division's principal objectives or destroys the designated enemy force.

Main attacks are characterized by mass concentrations of fire coupled with rapid violent and bold advances, and dedicated combat service and combat service support. The momentum of the attack is maintained until the mission is accomplished.[3]

Supporting attacks exist to assist the main attack. The mission of a supporting attack force must state clearly how it is to render this assistance, by limited objective attacks, seizing critical terrain, fixing the enemy in position, preventing enemy disengagement, deceiving him as to the location of the main attack, and forcing commitment of enemy reserves early or at an indecisive point.[4]

TACSAT considerations for the close fight should include forces participating in the operation, mobility of the force, priority of effort, key decision points or logistical support actions, liaison with adjoining forces and tactical operation center locations.

Once a commander task organizes his forces, he must identify command and control nodes that are critical to mission success. After identifying those nodes, he must analyze the situation to determine if the area common user and combat net radio systems can provide continuous and reliable communications throughout the attack. If the operational tempo of the mission can possibly out run the terrestrial based

communications systems, he may allocate TACSAT as a means of building in robustness into the architecture.

If the commander determines that logistical support plays a major role in mission success, he may opt for placing TACSAT systems in the COSCOM or DISCOM. He can also consider placing TACSAT with the medical or engineer elements to control or track critical events in the mission. He may also see a requirement to put TACSAT systems with the Military Police to help with refugee control or main supply route monitoring.

If the mission dictates the requirement for liaison elements with adjacent commands, both joint and combined, the commander may have to use his assets to support the operations. The commander may also request support from the next higher command.

The commander must take into consideration his requirement to provide TACSAT assets to the field headquarters at the Tactical Operations Center (TAC), Main Command Post, and Rear Command Post. The TAC is responsible for controlling the close fights so they heavily employ TACSAT. The main CP controls the deep fight and plans the next battle, again they heavily employ TACSAT. The Rear CP acts as the sustaining headquarters and alternate command post for the TAC and Main CPs. Use of TACSAT assets at the Rear CP is mission dependent.

Offensive Rear Operations

In the Offense, the Rear Command Post is heavily committed to coordinating and facilitating the push of combat service support forward to sustain the attack. The Rear CP is concerned with providing sustainment to forward units, clearing main supply routes, evacuating

casualties, equipment and enemy prisoners of war. The Rear CP is also responsible for preparing to reestablish combat service support bases forward and conducting rear operations.[5]

A commander must be particularly careful when considering allocating TACSAT assets to CSS units. CSS units generally function in single discipline activities that are spread throughout the corps area. Attempting to issue TACSAT terminals to ammunition points, fuel haulers, ambulance exchange points or maintenance facilities may be misusing valuable assets. A commander should not allocate TACSAT systems positions that have little or no positive impact on the unit or on mission success.

Defensive Operations

The defense operation is a temporary state that creates conditions that permit the friendly unit to survive the initial shock of the enemy attack, to halt the enemy, and then exploit the initiative and go on the offensive. Divisions will perform multiple operations in support of a corps level defense. The division employs three types of defense; area defense, mobile defense, or a combination of the two defenses. A mobile defense focuses on the enemy force and area defense focuses more on holding terrain. A corps conducting defensive operations uses a defensive framework to structure its' defense. The corps defensive framework includes the deep operations, security operations, the main battle area, reserve operations, and rear operations.

Defensive Deep Operations

The primary focus of the defensive deep operations is to interdict by delaying, disrupting, or diverting enemy reserves, then shifting to enemy units' second echelon positions. Commanders conduct deep operations as an economy of force operation that allows for the destruction of uncommitted forces that could influence the outcome of friendly close defensive operations. The means for conducting deep operations included field artillery, attack aviation, and mounted and dismounted infantry.

When analyzing TACSAT considerations to support deep operations, the commander must first identify his command and control requirements. He must consider if there is a requirement to maintain contact with the force conducting the deep operations for the duration of the mission.

The force may require intelligence updates enroute to the target area or updates on target priorities.

The commander may require that the deep force provide the corps or division with updated intelligence enroute to the target area. He may require that they identify troop concentrations or special weapons employed by the enemy force. The deep force may have to report on disposition of river crossings or battle damage assessment for a previous mission.

Another consideration is if the corps or division provides in own combat search and rescue (CSAR). In deep operations, line-of-sight radio systems are of little value for call in emergency exfiltration or medical evacuation. TACSAT may be the only reliable means of communications for over-the-horizon CSAR.

Security Operations

The Corps and division conducts security operations forward, rear, and to its flanks to protect its freedom of action by reducing its vulnerability to hostile acts, influence, or surprise. The covering force protects the main battle area (MBA) units from surprise, allows MBA forces time to deploy and move to meet enemy attacks, prevents the delivery of enemy medium range artillery fires, and deceives the enemy as to the location of the main defensive positions.[6]

The commander should consider allocating whatever TACSAT assets required to ensure continuous and reliable communications with the security or covering force. The covering forces' timely report to the headquarters on enemy movement and disposition is paramount for force protection and mission success. By the very nature of the covering or security force, a communications link must be deployable, dependable, quick to erect and break down, and provide immediate response to the command post. TACSAT is well suited for the covering force mission.

The Main Battle Area

The overall battle matures in the main battle area. The main battle area usually represents the critical area for the defeat of the assaulting enemy forces.

TACSAT considerations for the main battle area should include forces participating in the operation, mobility of the force, priority of effort, key decision points or logistical support actions, liaison with adjoining forces and tactical operation center locations.

Once a commander task organizes his forces, he must identify command and control nodes that are critical to mission success. After

identifying those nodes, he must analyze the situation to determine if the area common user and combat net radio systems could provide continuous and reliable communications throughout the defense. If the commander employs an area defense, he can probably take full advantage of the existing terrestrial systems and use TACSAT only as a redundant means of communication. If he employs a mobile defense, he may have to consider using TACSAT to link himself with his subordinate commanders and staff.

If the commander determines that logistical support plays a major role in mission success, he may consider placing TACSAT systems in the COSCOM or DISCOM. He could also consider placing TACSAT with the medical or engineer elements to control or track critical events in the mission. He may also see a requirement to put TACSAT systems with the Military Police to help with refugee control or main supply route monitoring.

As with offensive operations, the commander must also take into consideration his requirement to provide TACSAT assets to the field headquarters at the Tactical Operations Center (TAC), Main Command Post, and Rear Command Post. The TAC is responsible for controlling the close fights so they heavily employ TACSAT. The main CP controls the deep fight and plans the next battle, again they heavily employ TACSAT. The Rear CP acts as the sustaining headquarters and alternate command post for the TAC and Main CPs. Use of TACSAT assets at the Rear CP is mission dependent. The commander may also see a requirement for liaison elements with adjacent commands.

Reserve Operations

The primary purpose of the reserve force is to give the commander flexibility and retain the initiative throughout offensive or defensive actions. The commander should consider if the command and control link to the reserve is timely and reliable. The commander normally locates to reserve in the rear of the corps or division and is supported by the area common user network and the combat net radio system. A commander may choose to allocate TACSAT assets to the reserve commander to ensure communications redundancy. If the commander calls the reserve forces, especially in the defense, he does not have time to work around communications difficulties and outages.

Rear Operations

The corps and division plans and conducts rear operations to assure freedom of maneuver and to sustain its operations. As with offensive operations, a commander must be particularly careful when considering allocating TACSAT assets to CSS units. However, in the defense, forces are less mobile and less dispersed so the command could make more TACSAT assets available to the CSS unit.

Endnotes

[1]U.S. Army, FM 71-100, Division Operations, Washington, DC, Department of the Army, June 1990,4-4.

[2]Ibid., 1-18.

[3]Ibid., 4-7.

[4]Ibid., 4-8.

[5]Ibid., 4-16.

[6]Ibid., 5-4.

CHAPTER 6

CONCLUSION

Introduction

The Warfighter Net is the primary doctrinally approved single channel tactical satellite net for the Corps and Division Commander. The Warfighter Net passes orders and immediate command and operational information. The commander may use this net for tactical command and control, combat coordination, and tactical data reporting. A Warfighter Net can employ it in the deep fight to support long range surveillance units, in the close fight to support maneuver and support forces, and in the rear fight to support the Corps/Division Support Commands.

The Warfighter Net is the Commander's net. He may distribute ground terminals based on mission requirements and personal preferences. Flexibility and mobility are the most critical aspects of the architecture.

The commander's TACSAT considerations for reconnaissance operations include enroute communications requirements, size, weight and mobility of the reconnaissance force. TACSAT considerations for the deep operations include any command and control issues, enroute communications and intermediate staging base requirements. The TACSAT considerations for the close and rear operations include supporting the maneuver forces, redundancy communications, and communications augmentation to the Combat Support and Service Support forces.

The thesis in no way intended to dictate to a commander how he must deploy his single channel assets, however, it did present considerations a commander should take into account when allocating assets. The considerations outlined the capabilities, limitations and requirements of TACSAT communications in support of a force conducting offensive, defensive, and retrograde operations. Only after the commander has contemplated these considerations is he able to decide ground terminal distribution. A commander who properly allocates his signal channel assets will increase the probability that he can contact his subordinate commanders while on-the- move, monitor their communications and synchronize his forces. A commander who fails to allocate his TACSAT assets properly may reduce his force to nothing more than small pockets of resistance.

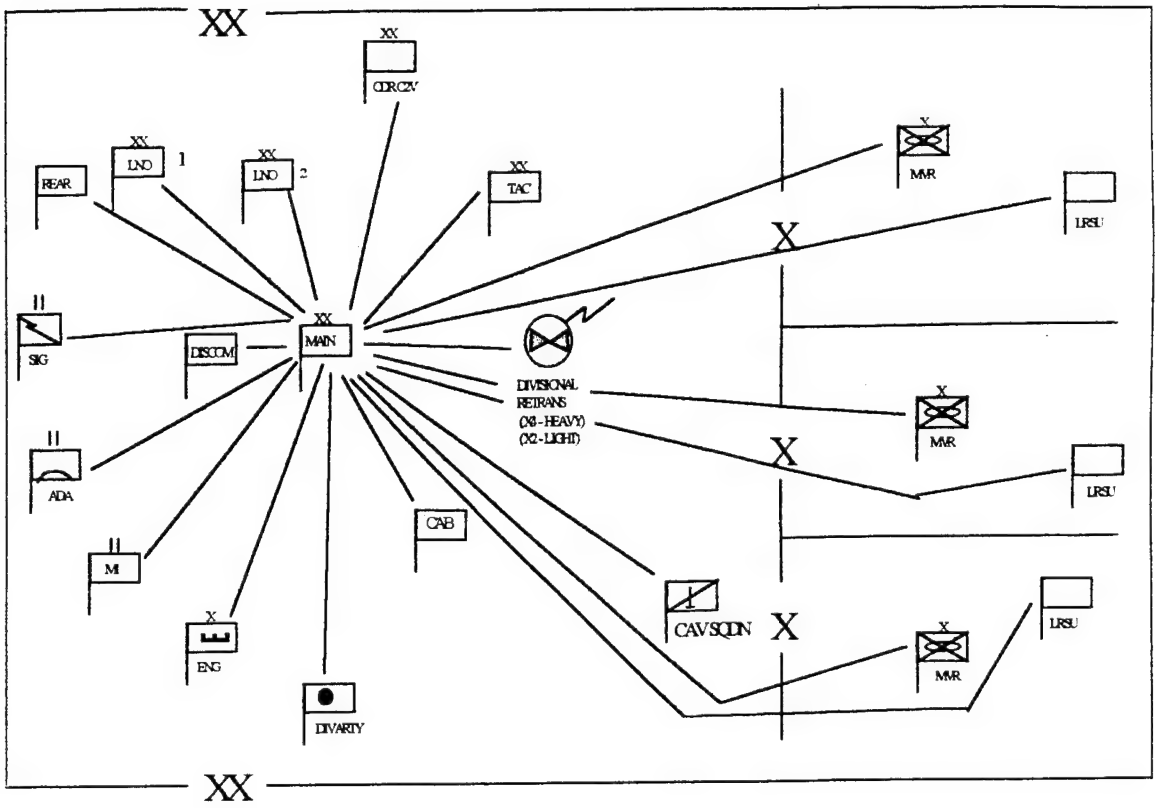

Figure 1. An example of the architecture for a division Warfighter Net

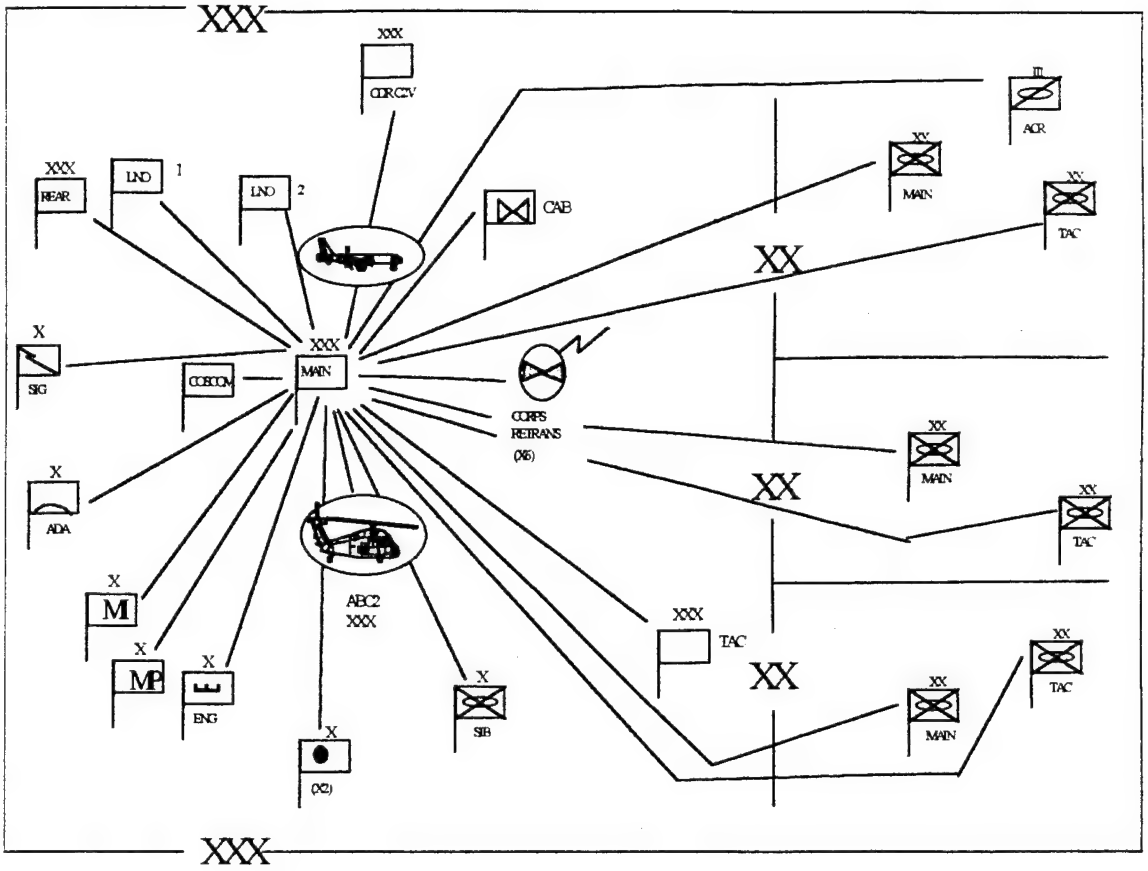

Figure 2. An example of the architecture for a corps Warfighter Net.

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